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SOME ASPECTS OF THE GROWTH PARAMETERS OF THE FISHES OF IBRAHIM ADAMU LAKE, KAZAURE JIGAWA STATE, NIGERIA

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ABSTRACT
The growth parameters and age for the fish species from the lake (O. niloticus, S. galilaeus and B. bayad) were computed through interpretation of marks found on their Opercula bones which were then fitted into Vonbertallanfy growth model. Their asymptotic length (L∞) ranged from 175mm – 520nm. The growth performance index Φ′ ranged from 3.6622 – 4.9420 and K value from 0.10 – 0.35. O. niloticus L∞, K and Φ′ values ranged from 175mm- 192.5mm, 0.15 – 0.25, 3.6622 – 3.9668 and were found to live up to 7+ years in the lake. The values of S. galilaeus ranged from 200mm – 240mm, 0.12 – 0.17 and 3.8211 – 3.8222 and living up to 5+ while B. bayad had a range of 500mm – 520mm, 0.10 – 0.35, 4.4320 – 4.9420 and lives up to 6+ in the lake. All the growth parameters for the fish species were fitted into the Vonbertallanfy growth model.
$L_t=L\infty\ (i-^{e}-^{k}\ (t-t_o)$
Keywords: Growth parameters, Age, Ibrahim Adamu Lake.

INTRODUCTION

Studies on the age and growth pattern play a very important role in fisheries management (Mohr, 1927). The studies on growth are components of fish stocks and are used to characterize the state of various fish populations. The method used is by counting the growth zones which appears on the hard parts of fishes, like the scales, opercula bones and otoliths. These marks are called annuli or rings and are formed during periods of faster and slower growth (Bilton, 1974). A lot of work has been done on the ageing of fishes. It includes those of Velaso *et al.,* (1990); Getabu (1992); Patraki and Stergiou (1995); Jiminez *et al.,* (2000); Ogueri, C., (2001); Doug, Darr (2008); Kumalo *et al.,* (2010) and Gheslagi *et al.,* (2012). The aim of the paper is to provide baseline information on the lake's fishes for better management.

MATERIALS AND METHOD

a. Study Area

Ibrahim Adamu Lake is located in Kazaure town of Jigawa State, 735km from the State Capital Dutse on 13^{o} along the line of Latitude (Figure 1). The lake was constructed in 1974 with the primary aim of town water supply, irrigation, fisheries and secondary aim of recreation and wildlife conservation (WRECA, 1976).

b. Sample Collection

Sampling was carried out monthly for 24 months from October, 2003 – September, 2005 from different sampling stations (Figure 2) using different fishing gears viz: traps, cast nets of "2-10" mesh and hooks. The fish caught were placed on ice box and brought to the Research Laboratory immediately.

Three fish species, *O. niloticus, S. galilaeus* and *B. bayad* were the common species found in the lake. Each fish species was identified and their body weight, total length and standard length were measured. Total length (TL) and standard length (SL) were measured using the method of Lagler (1970). Total length (mm) was measured as the length of a fish from its anterior most extremity to the end of the caudal fin while standard length (mm) was measured as the distance of the fish from its most anterior extremity (Mouth closed) to the end of the caudal peduncle. Weight were measured using top loading balance in (kg). Mathematical expression is required to express the growth of fish. The best known growth model used in fisheries assessment is that of Von-bertalanffy, who based his formulation on physiological Characteristics of fish. The Vonbertalanffy growth model of 1957 describes growth curves as expressed by the formula.

$L_t=L\infty\ (i-e^{-k}\ (t-t_o)$ – (1)

Where

L_t = Length at age "t"
L∞= Asymptotic length or
Maximum attainable length
k = Rate at which the asymptotic length is approached
t_o = A time in the growth history of the fish at which the fish would have been zero sized.
e = An exponent
t = Age in years

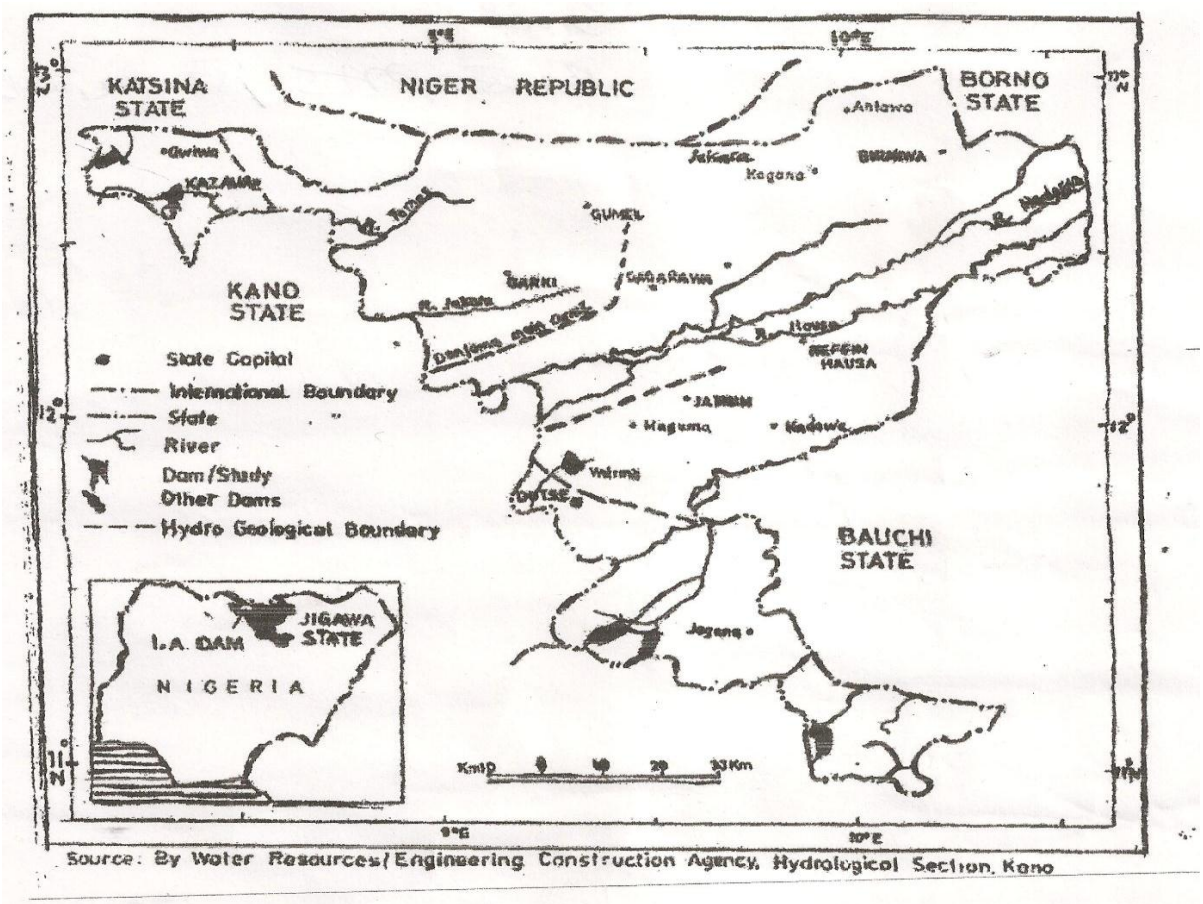


FIG 1: JIGAWA STATE DRINAGE/HYDROLOGY SHOWING LOCATION OF IBRAHIM ADAMU DAM

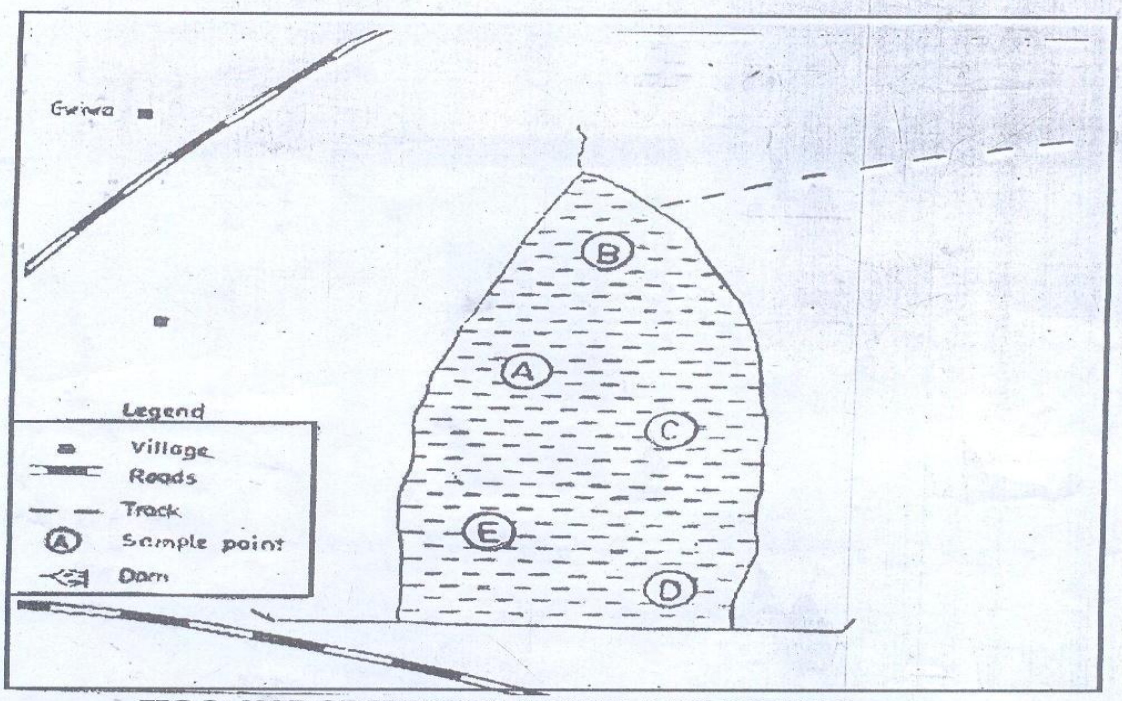


FIG 2: MAP OF IBRAHIM ADAMU DAM, KAZAURE SHOWING SAMPLING SITES A, B, C, D, E,

Growth curves were then fitted to the Vonbertallanfy model and tested with Walford plots (Walford, 1964; Berveton and Holt, 1957 and Ricker, 1975).

From the Walford plot, a trial L∞ was obtained. Equation (1) could be re-arranged and transformed into a straight line by taking natural logarithm.

$Log_e (L\infty - L_t) = Log_e L\infty + kt_o - kt$ —(2)

From the trial L∞, five values were obtained by successive addition of 1 to the trial L∞ twice and successive subtraction of 1 twice from it.

Trial plots of $Log_e (L\infty - L_t)$ against age (where L∞ is the trial value; L_t= length at age) were performed using the method of Ricker (1975) and the line of best fit (straightest) was selected by eye or by computation from the five graphs to obtain the true L∞. The gradient which is = k and $k = e^{-k}$;

$Log_e L\infty + Kt_o$ is the intercept, then:

$$t_o = \frac{Y-axis\ intercept - Log_e\ L\infty}{K} - (3)$$

Where K is the gradient of the line of best fit from the trial plots of $log_e (L\infty - L_t)$ against age. Thus the Vonbertalanffy growth parameters L∞, K and t_o in equation (1) were determined.

The growth performance index was calculated using the equation devised by Pauly (1988).

$$\Phi' = \log_{10}K + 2\log_{10} L\infty - (4)$$

Where L∞ and K are parameters of Von bertalanffy growth equation.

RESULTS

A total of 2903 species were examined during the study period and their length ranged from 20mm – 220mm and weight was from 20g – 200g. 2,013 species of *O. niloticus* were encountered and their growth parameters were L∞=192.5mm, K=0.25, t_o=0.12, Φ' = 3.9668 and L∞ = 175mm, K=0.15, t_o = 0.66, Φ' = 3.6622 for male and female *O. niloticus* respectively. The example of Walford and Ricker plot for the determination of the age of male and female *O. niloticus* from Ibrahim Adamu lake are shown in figures 3a – 3d.

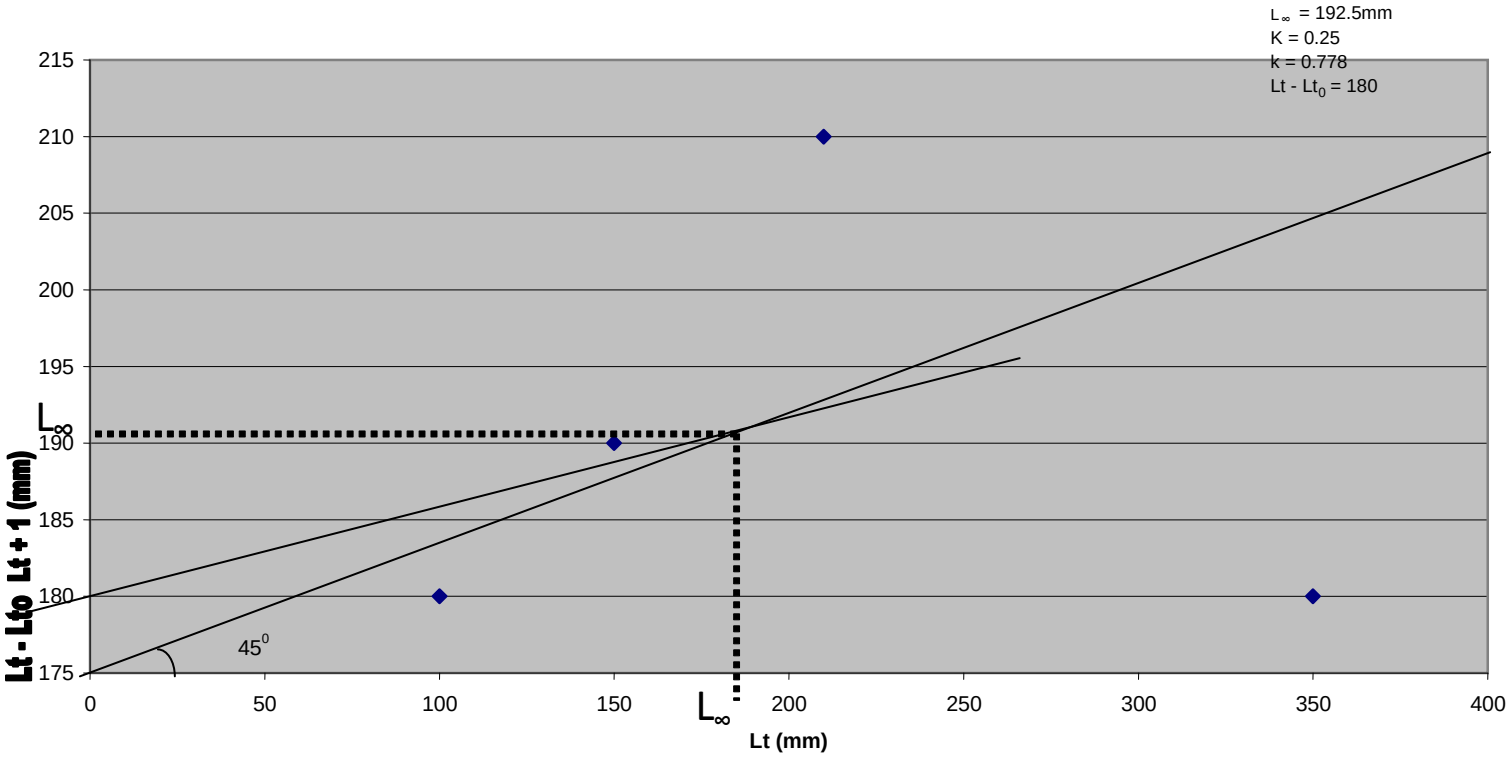


FIG 3a: WALFORD PLOT OF MALE *O. niloticus* FROM IBRAHIM ADAMU LAKE

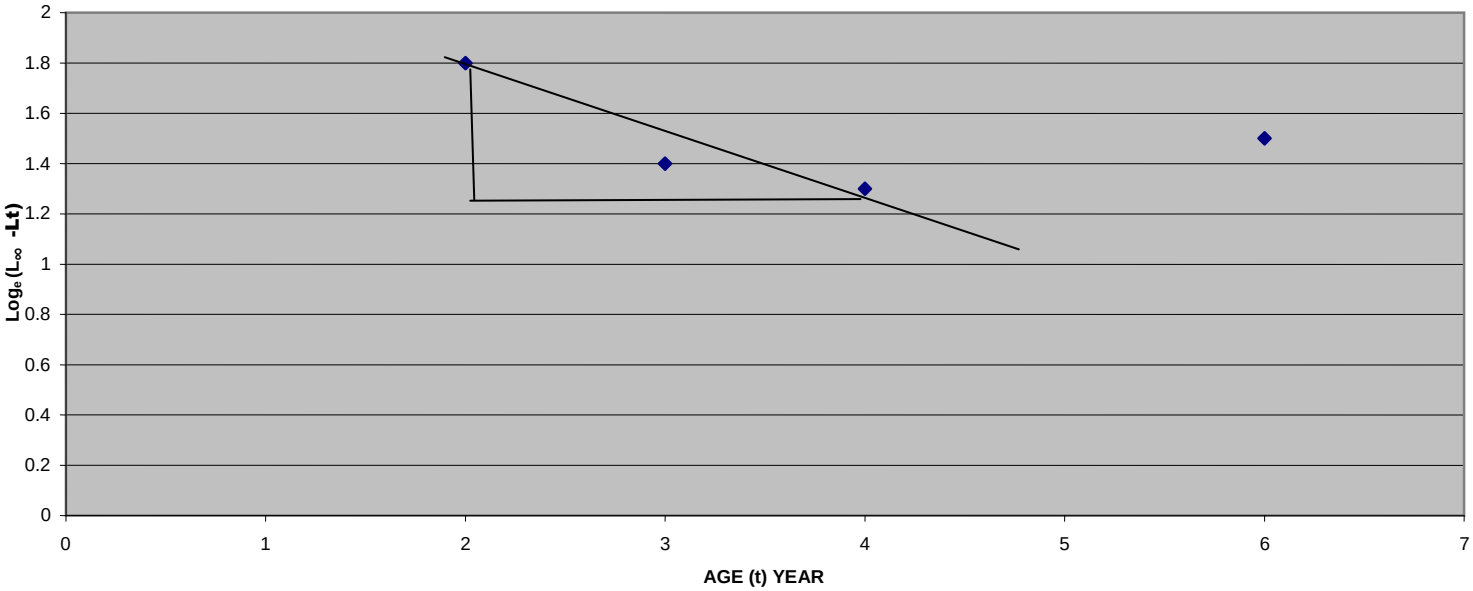


FIG 3b: RICKER PLOT FOR THE DETERMINATION OF TRUE L$_\infty$ OF MALE *O. niloticus* FROM IBRAHIM ADAMU LAKE

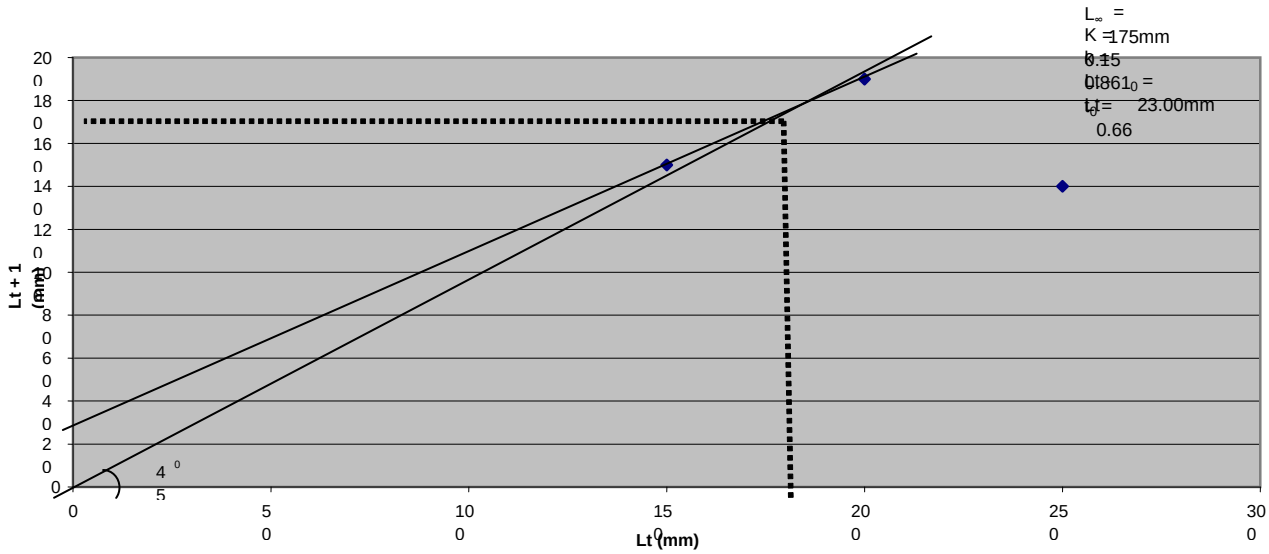


FIG 3c: WALFORD PLOT OF FEMALE *O. niloticus* FROM IBRAHIM ADAMU LAKE

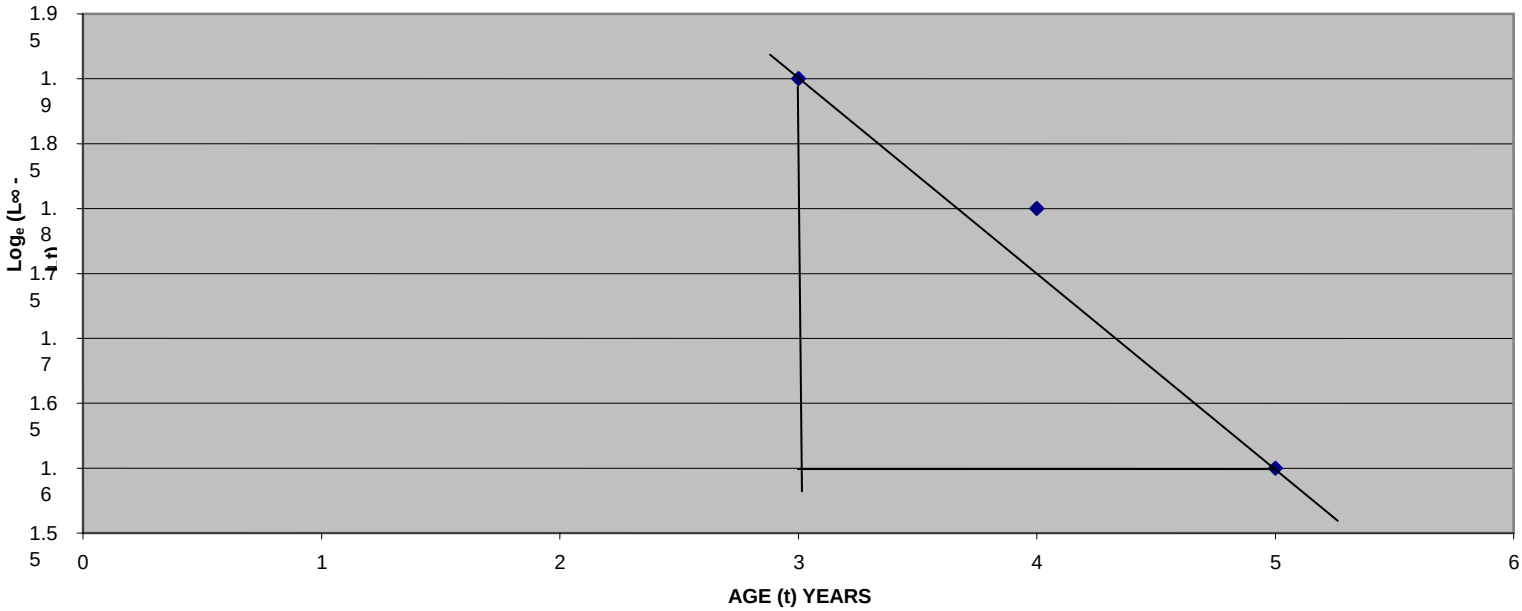


FIG 3d: RICKER PLOT FOR THE DETERMINATION OF TRUE L∞ OF FEMALE *O. niloticus* FROM IBRAHIM ADAMU LAKE

A total of 337 *S. galilaeus* were caught and their growth parameters were L∞ = 200mm, K=0.17, t_o=0.30, Φ′ = 3.8222 and L∞= 240mm, K=0.12, t_o=0.86, Φ′ = 3.8211 for male and female species.

553 species of *N. bayad* were caught during the study period with L∞ = 520mm, K=0.10, t_o 0.50, Φ′ = 4.4320 and L∞ = 500mm, K =0.35, t_o = 0.85 and Φ′ 4.9420 for male and female species. Tables 1 and 2 shows the growth parameters and back calculated length at age for the fish species of the lake.

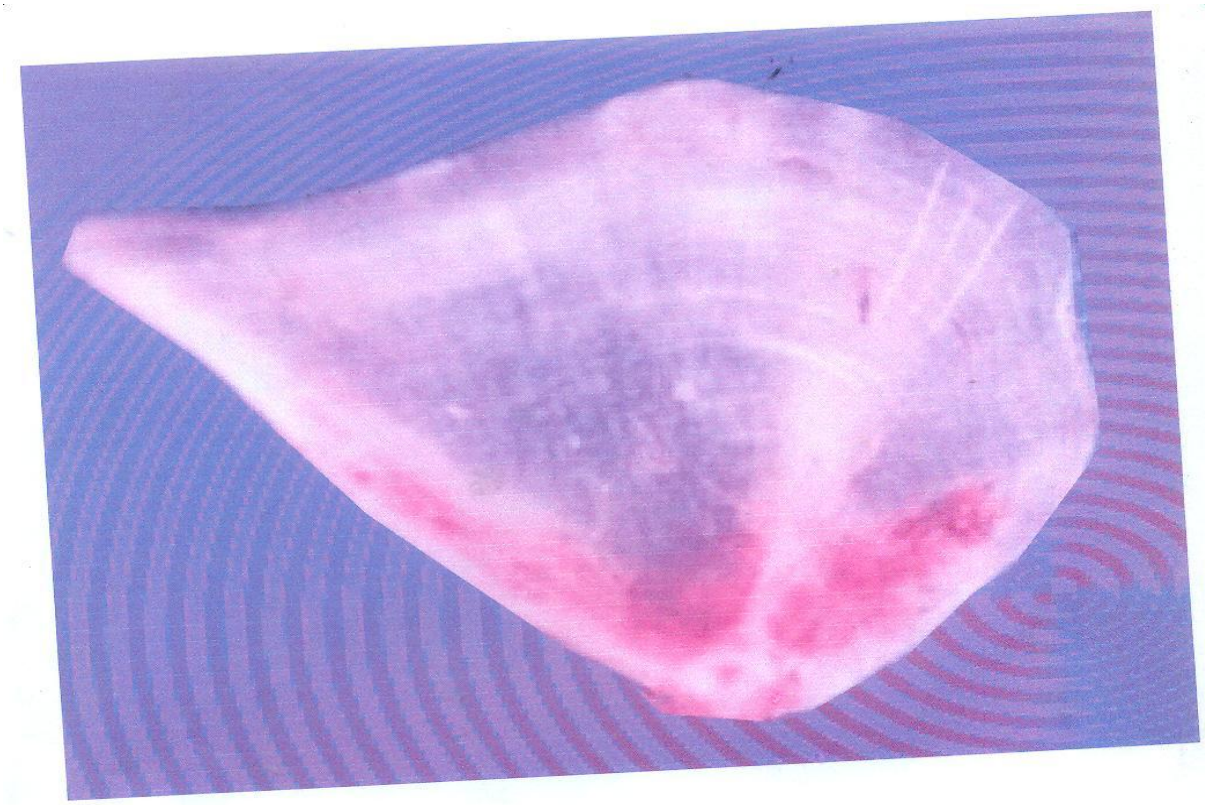
Table 1: Growth indices and growth performance index (Φ′) of the fishes from Ibrahim Adamu Lake, Kazaure, Jigawa State.

Fish Species	Sex	L∞	K	t_o	L_t - L∞	Φ'
O niloticus	♂	192.5	0.25	0.12	180	3.9668
	♀	175	0.15	0.66	23	3.6622
S. galilaeus	♂	200	0.17	0.30	65.5	3.8222
	♀	240	0.12	0.86	100	3.8211
B. bayad	♂	520	0.10	0.50	200	4.4320
	♀	500	0.35	0.85	100	4.9420
		500	0.35	0.85	100	4.9420

Table 2: Mean back calculated, Length at age of fishes from Ibrahim Adamu lake, Kazaure, Jigawa State.

Species	Age	L_1	L_2	L_3	L_4	L_5	L_6	L_7
O. niloticus	2+	52.2	97.5					
♂	3+	80	100	120				
	4+	75	96	107	128			
	5+	60	90	110	130	140		
	6+	60	80	100	110	140	160	
	7+	83.12	106.88	118.8	134.83	142.5	154.4	166
Mean		68.72	81.48	111.16	125.7	140.83	157.2	166
♀	3+	65	92.8	103.1				
	4+	90	110	120	130			
	5+	63	99	108	135	144		
	6+	79.3	88.1	96.9	105.7	114.5	149.8	
	7+	82.6	90.9	107.4	105.7	123.9	140.14	148
Mean		75.98	96.2	107.1	121.6	127.5	145.1	148
S. galilaeus								
	2+	116.3	13.42					
♂	3+	89.5	121.4	137.6				
	4+	100	127.3	163.64	181.8	200.86		
	5+	95.65	124.3	153.04	181.74	200.86		
Mean		100.36	126.81	151.43	181.77	200.86		
♀	2+	100	133.33					
	3+	95.63	116.88	138.13				
	4+	104.8	125.7	157.1	188.6			
Mean		100.14	125.30	147.6	188.6			
B. bayad	2+	169.4	188.2					
♂	3+	307.7	338.5	369.2				
	4+	277.9	301.1	347.4	393.7			
	5+	270.6	296.6	324.7	351.8	378.8		
	6+	293.3	320	346.7	373.3	389.4	426.7	
Mean		263.78	288.9	347	372.9	384.1	426.7	
	2+	130	156					
♀	3+	185.5	216.4	247.3				
	4+	265.3	287.4	831.6	375.8			
	5+	411.4	445.7	377.1	411.4	445.7		
Mean 248.1		248.1	276.4	318.7	393.6	445.7		

Key: L_1 – L_7 = mean back calculated length at age



Opercula bone of female *O. niloticus* from Ibrahim Adamu Lake Aged 5^+

Figure 4: Operula bone of female O. niloticus from Ibrahim Adamu Lake aged 5^+

DISCUSSION

The Vonbertalanffy growth model (VBGM) adequately described the growth of the fish species in the lake which are of great importance in this study. In the lake, K values were between 0.1 – 0.35. Species such as *B. bayad* had K value of 0.35 which shows that it has the tendency to live long and grow bigger when compared to species as demonstrated by its length (520mm), *S. galilaeus* (240mm) while *O. niloticus* had 175mm as shown in table 1. These results are comparable to those obtained by Deekae (2010) for species in Luubara creek in Ogoni Land, Niger Delta. Nigeria ($L\infty$=82.65mm, K=1.98, t_o=0.48, Φ' = 3.980). Lower values were however recorded by Forest (1975); $L\infty$=25.16mm, K=0.203, t_o= 0.3670: Rousset and Morino (1983): $L\infty$ =23.7, K=0.380, t_o = 0.88 and Dinis (1986); $L\infty$ =27.710, K=0.28, t_o = - 0.944.

The growth performance index ranged from 3.622 – 4.9420. *B. bayad* had the highest value of 4.9420 and appear good species for aquaculture and is a preferred fish in the area and so high priced. Getabu (1992) indicated that besides the genetic make up which determines the growth potential of the species, overfishing, diet type and its utilization could affect the growth performance index of a particular species even though the growth performance index is a function of $L\infty$ (increase in $L\infty$ leads to increase in growth performance index) as shown in Table 1. *O. niloticus* attains age of 7^+ in the lake(Table 2). The growth performance estimated for the fish species in the lake will allow for comparison of growth performance index among fish species in other parts of Nigeria when the estimates are available. Enin *et al.,* (1995) suggested that the growth performance index can be used to calculate $L\infty$ and K of related species when either of the parameter is available.

The growth parameters obtained for the lake are similar and this shows similar growth pattern for the fish species in the lake.

CONCLUSION AND RECOMMENDATIONS

The growth parameters recorded for the fish species compared favourably with other results. All the values $L\infty$, K, t_o and Φ' are similar and will allow for comparison of growth performance of species from similar water bodies. The higher $L\infty$ values recorded for the fish species in the lake shows that the fish species could grow to full potential when left in the lake and so the need to enhance the present system of fishing by the use of appropriate fishing technology in order to reduce overexploitation of the lake fishes. This can improve fish production which will reduce protein malnutrition to the state populace and Nigeria at large.

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